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Augmentative and Alternative Communication Intervention for Children with Autism Spectrum Disorders

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1. Introduction

The main purpose of this chapter is to present the field of augmentative and alternative communication (AAC) intervention, its application to children with autism spectrum disorders (ASD), and what we know of the effects so far.

2. Communication in children with autism spectrum disorders

2.1 Difficulties with communication and language as part of the spectrum

Major advances have been made over the two past decades in understanding the social-communication difficulties of children with ASD, resulting in greater emphasis on early social-communication features in the diagnostic criteria (Wetherby, 2006). The second of the three main criteria for autism in both diagnostic systems (DSM-IV and ICD-10) specifically concern communication, while the first concerns impairment in social interaction, which involves body communication to a great extent (table 1). Most parents of children with autism first begin to be concerned that something is not quite right in their child's development because of early delays or regressions in the development of speech (Short & Schopler, 1988). Problems with communication, in terms of both understanding and expression, are often said to be one of the main causes of the severe behaviour problems that are common among persons with severe autism and mental retardation (Carr et al., 1997). The lack of meaningful, spontaneous speech by age five has been associated with poor adult outcomes (Billstedt, 2007; Billstedt, Gillberg, & Gillberg, 2005; Howlin, Goode, Hutton, & Rutter, 2004; Shea & Mesibov, 2005). Certainly, communication and communication problems are at the heart of what ASD is all about.

Although all persons diagnosed with autism have problems with communication, their type and degree vary a lot and the work of identifying different subgroups has just begun. It has been estimated that between one-third (Bryson, 1996) and one-half (Bryson, Clark, & Smith, 1988) of children and adults with autism have no speech. However, recent research results indicate that the proportion of non-speaking children with ASD is much smaller, approximately 14% to 20%, among those who received very early intervention (Lord, Risi, & Pickles, 2004).

Two phenotypes of speaking children with ASD were identified by Tager-Flusberg and Joseph (2003): children with normal linguistic abilities (phonological skills, vocabulary,

syntax, and morphology) and children with impaired language that is similar to the phenotype found in specific language impairment. Another potential subgroup may experience verbal dyspraxia or dyspraxia of speech (Rogers, 2006; Tager-Flusberg, Paul, & Lord, 2005; Wetherby, Prizant, & Schuler, 2000). Voluntary motor control is disturbed in children with dyspraxia, which also affects their ability to imitate. The new research on the role of the 'mirror neurons' in the parietal and frontal lobes may provide some answers on the relationships between motor control and imitation but also on the possible link with the development of intersubjectivity (Rogers, 2006).

In spite of the heterogeneity of language abilities in children with ASD, social-communication or pragmatic impairments are universal across all ages and ability levels (Tager-Flusberg, Joseph, & Folstein, 2001). According to Wetherby (2006), the social-communication deficits in children with ASD can be organized into two major areas: (1) the capacity for joint attention and (2) the capacity for symbol use. Since joint attention emerges before words, this deficit may be more fundamental and a number of longitudinal studies provide evidence of a relationship between joint attention and language outcomes (Charman et al., 2003; Mundy, Sigman, & Kasari, 1990). According to Wetherby (2006, p. 11), 'deficits in initiating and responding to joint attention have a cascading effect on language development since language learning occurs within the context of the modelling by the caregiver of words that refer to objects and words that are jointly regarded'. Wetherby (2006) states that deficits in imitation and observational learning are other main causes of the problems with symbol use experienced by children with ASD. Learning shared meanings, imitating and using conventional behaviours, and being able to decontextualize meaning from the context constitute the symbolic deficits in children with ASD (Wetherby, Prizant, & Schuler, 2000).

2.2 Development of communication and language in children with ASD

Because autism is usually not diagnosed until age three or four, there is relatively little information about language in very young children with autism (Tager-Flusberg et al., 2005). Retrospective studies using parent reports and/or videotapes collected during infancy, together with studies of children considered likely to develop autism, show severely delayed language acquisition with respect to both receptive and expressive skills (Dahlgren & Gillberg, 1989; Osterling & Dawson, 1994; Watson et al., 2007). Another typical phenomenon described by 25% of parents of children with ASD is language loss after initially developing some words (Chawarska et al., 2007; Kurita, 1985). Lord, Schulman, and DiLavore (2004) found that this language regression is unique to autism and does not occur in other children with developmental delays. Chawarska et al. (2007) hypothesize that these early-acquired speech-like productions are lost by children with ASD because the link between these expressions and a network of symbolic communication fails. There is significant variability in the rate at which language progresses among children with ASD who do acquire speech.

The few longitudinal studies of language acquisition in children with ASD suggest that progress within each domain of language follows similar pathways as it does in typically developing children (Lord et al., 2004; Tager-Flusberg et al., 2005). However, the speech of children with ASD is also characterized by some typical deviations. One of the most salient aspects is the occurrence of echolalia, which can be either immediate or delayed. Although some echolalia seems to be self-stimulating, both types of echolalia can serve communicative

purposes for the speaker (Tager-Flusberg et al., 2005). At an early stage of language development, this may be the only way in which the child can actually produce speech. Tager-Flusberg et al. (1990) found that, over the course of development, echolalia rapidly declined for all the children with ASD and Down's syndrome in their study. Another prominent feature of language in children with ASD is general problems with deixis, which are most often manifested as pronoun confusion (Tager-Flusberg et al., 2005). Features such as vocal quality, intonation and stress patterns often result in problems for persons with ASD, although there is a lack of research in this field. Taken together, the findings suggest that the difficulties are due not only to problems in social intent but also to problems affecting a more basic aspect of vocalization (Tager-Flusberg et al., 2005).

Less research attention has focused on the comprehension skills of individuals with ASD although deviations in response to language and comprehension have been found to be strong indicators of ASD (Dahlgren & Gillberg, 1989; Lord, 1995). According to Tager-Flusberg et al., it seems that ASD children 'not only may have limited ability to integrate linguistic input with real-world knowledge but also may lack knowledge about social events used by normally developing children to buttress emerging language skills and to acquire increasingly advanced linguistic structures' (Tager-Flusberg et al., 2005, p. 350).

The pragmatic aspects of language have been studied in numerous ways. Children with autism share important similarities across different language levels (Tager-Flusberg et al., 2005). The speech acts that are missing or rarely used in the conversations of children with autism often concern social, rather than regulatory, uses of language (Wetherby, 1986). Ghaziuddin and Gerstein (1996) suggested that people with Asperger syndrome do not engage much in turn-taking and may talk too much. Ramberg, Ehlers, Nydén, Johansson, and Gillberg (1996) found that children with ASD were impaired in taking turns during dyadic conversations. Tager-Flusberg and Anderson (1991) found that children with autism had difficulty dealing with new information and produced more noncontingent utterances. A higher proportion of initiations rather than responses was found in a study by Bishop, Hartley, and Weir (1994). Tager-Flusberg et al. (2005) suggest that there is a basic difficulty in establishing and maintaining reciprocity in conversation – that is, in the ability to engage in mutual, co-operative social dialogue. Although the basic intention to communicate often exists, the person with autism has impaired skill in participating in communicative activities involving joint reference or shared topics (Tager-Flusberg et al., 2005, p. 354).

3. Augmentative and Alternative Communication (AAC) for individuals with ASD

3.1 Which children are in need of AAC intervention?

As stated above, many individuals with ASD never develop functional speech, while those who do still have problems with language and communication to different degrees, in different situations and during different periods in their life. 'The need for a range of augmentative strategies to enhance the communication skills of children with autism is evident given the severity and pervasiveness of their speech and language deficiencies' (Howlin, 2006, p. 237).

Augmentative and Alternative Communication is the term used since the 1980s for the field, which encompasses research, clinical and educational practice. The American Speech-Language-Hearing Association (ASHA) defines AAC as 'attempts to study and when necessary compensate for temporary or permanent impairments, activity limitations, and

participation restrictions of persons with severe disorders of speech-language production and/or comprehension, including spoken and written modes of communication (ASHA, 2005, p. 1).

AAC should be thought of as a system with four primary components: symbols, aids, strategies and techniques (ASHA, 2005, pp. 1–2). Symbols of various kinds can be included in an AAC system: graphic, auditory, gestural, and textured or tactile symbols, which may be unaided (such as signs, gestures or facial expressions) or aided (such as real objects, pictures, line drawings, or orthography). Aids refer to electronic or non-electronic objects that are used to transmit or receive messages, and techniques to the ways in which messages can be transmitted. Finally, strategy refers to the ways in which messages can be conveyed most effectively with respect to, for instance, timing, grammatical formulation or communication rate (Beukelman & Mirenda, 2005). According to Beukelman and Mirenda (2005), the ultimate goal of an AAC intervention is to enable an individual to efficiently and effectively engage in a variety of interactions and participate in the activities of their choice.

Von Tetzchner and Martinsen (2000) have defined three different groups of individuals who need AAC: (1) the expressive language group, characterized by a gap between their understanding of other people's speech and their ability to express themselves through spoken language. The difficulties of this group are persistent and they need an AAC system that can be used permanently. (2) The supportive language group needs an AAC system at certain periods of their life or in certain situations and is divided into two subgroups in this respect: the developmental group and the situational group. For the developmental group, the AAC is often a step towards the development of speech. The situational group is made up of individuals who have learned to speak, but who have difficulty in making themselves understood, most often with people who do not know them well. (3) Finally, the alternative language group consists of individuals who will need their alternative language form for the rest of their lives. Intervention comprises both comprehension and production and the communication partners will also need to use the AAC mode. Von Tetzchner and Martinsen (2000) specifically mention children with autism as belonging to the third group. This is often true of children with autism and intellectual disabilities and definitely of those who do not develop speech. Probably the majority of children diagnosed within the autism spectrum who develop speech fall within the supportive language group, often due to their persistent problems with the comprehension of speech and language. Some rare individuals with ASD might fit better into the expressive language group in that they only communicate through alphabet boards or speech-generating devices (SGDs) but have a comparatively good understanding of speech.

3.2 AAC and autism in a historical perspective

3.2.1 Manual sign communication

Historically, the first studies describing AAC techniques being used for persons with autism appeared in the 1970s; they reported on the use of sign language to improve communication (Howlin, 2006). These studies appeared at the same time as the unsatisfactory results of spoken-language-training programmes were being published. Studies by, for example, Lovaas et al. (1973) and Howlin (1989) reported little change after many hours of intensive treatment, and the results were particularly poor for the children whose comprehension and vocal skills were most impaired (Howlin, 2006). Initially, most signing programmes were built on formal sign language systems, but it became evident that these were often too complex and abstract, and so specially adapted systems were developed and implemented.

Sign-based programmes spread rapidly in schools for children with autism in many countries. This was also the case in Sweden, where the positive research results obtained by Johansson (1981), who used methods primarily involving sign communication for children with Down syndrome, influenced the communication programmes in most clinics and schools.

3.2.2 The shift to visual-graphic AAC

During the 1980's and 1990's a shift was seen within AAC practice for children with ASD. Use of manual sign communication decreased in favour of increased use of photos, pictures, and symbols alone or in combination with speech output on dedicated devices or computers. Mirenda and Erickson (2000) explain that the shift away from the use of signing to visual-graphic communication occurred as a result of research findings in three main areas: imitation, iconicity, and intelligibility. In addition to the evidence of a generalized imitation deficit in autism, there were also studies showing that some children with ASD had extremely poor sign imitation skills (Yoder & Layton, 1988) due to difficulties with motor planning, control and execution (Seal & Bonvillian, 1997). With respect to iconicity manual signing was thought to be too an abstract system for individuals on the autism spectrum, having easier to use and understand symbols with more resemblance to their referents. Problems with intelligibility refers to the fact that manual signs are not so easy to interpret for communication partners not so familiar with the child and/or the system of manual signing. According to Howlin (2006), the shift from the use of manual signs to visual methods was also due to the fact that visual methods had proven to be effective in enhancing general skill acquisition, mainly within the TEACCH programme (Treatment of Education of Autistic and related Communication-handicapped CHildren; Schopler, Reichler, & Lansing, 1980) developed during the 1970s. A variety of symbol systems were also developed, beginning with Blissymbolics (Bliss, 1965; Blissymbolics Communication International, 2011) and Rebus (Widgit Software, 2002; Woodcock, Clark, & Davies, 1968), followed by Pictogram (Maharaj, 1980) and Picture Communication Symbols (Mayer-Johnson, 1981). The improvements in computer technology made these symbol sets easily available in the form of practical software packages. The development of digital cameras during the 1990s also increased the possibility of including personal photos in AAC systems, which, according to clinical reports, seemed to increase motivation and facilitate understanding of pictures, particularly for individuals with ASD (Danielsson & Jönsson, 2001).

There are, however, also reports of problems in teaching symbols to children with ASD, mainly in teaching them to use the pictures spontaneously and for communicative functions other than requesting (Howlin, 2006). It was precisely these problems that led Bondy and Frost (1994) to develop the method called Picture Exchange Communication System (PECS). PECS is a systematic approach to communication training specifically developed for children with autism. The elements that make PECS different from other visual-graphic techniques are the use of the concrete hand-to-hand exchange of the picture and also the highly prescriptive user manual with its six levels to follow in sequence.

3.2.3 Speech output technologies and computer assisted instruction

Historically, the use of speech output technologies (i.e the use of dedicated and/or mainstraeam products, mainly computer applications, where it is possible to use synthetic

or digitized speech) for individuals with ASD has not been a matter of course (Schlosser & Blischak, 2001). Computer technology was introduced into educational settings for children with autism late, not only in North America, but also in Sweden. Three Swedish surveys done at the end of the 1990s (Eklöf Wicksell, 1998; Olsson, 1998; Thunberg, 2000) clearly revealed that the number of computers used at school and/or supplied by the county councils as personal communication aids was remarkably low compared to the situation for individuals with communication impairments with other causes than autism.

In Sweden, professionals feared that people with ASD would become even more aloof if they were encouraged to sit in front of a computer screen. Concerning speech-generating devices (SGDs i.e communication aids with speech out), a common view was that they would only stimulate echolalia in children with ASD, and that there would be too much noise in the classroom. By the end of the 1990s, scepticism had decreased. This was probably due to reports of some studies of successful computer-assisted instruction (CAI) carried out in Sweden. By using the interactive multimedia software Delta Messages, Heimann, Nelson, Tjus, and Gillberg (1995) showed that a group of 11 children with autism were able to make significant gains in reading, phonological awareness, verbal behaviour, and motivation. Another study within this project showed that 13 children with autism, regardless of the initial cognitive and language level, increased their reading skills and reading speed following the use of CAI (Tjus, Heimann, & Nelson, 1998). The interaction between the children and their teachers was also studied during the CAI sessions. It was suggested that the intervention promoted an increase in verbal expressions and enjoyment for the participating children, and specifically for the children with autism compared to the other children who were also included in the project. The children's verbal expressions were more relevant at the end of the study period, and this was most marked for the children at low language levels. Concerning the teachers' behaviour, it was seen that they tended to use more physical directives towards children with a low language level while the children with higher language levels received more praise (Tjus et al., 1998).

4. Evidence-based practice and AAC

The term evidence-based used as a prefix and a denominator of interventions and methods comes from medicine. The term evidence based means that the choices of interventions and assessments are based on a research of scientific literature and not only professional experience or previous practice. Within the field of AAC a discussion was started during the end of the 90's and in 2003 the book "The Efficacy of Augmentative and Alternative Communication. Towards Evidence-based Practice » was published (Schlosser, 2003). Editor and also author of many chapters of this book, was Ralph W. Schlosser, professor at NorthEastern University, USA. His work has been of great importance, partly because he is spreading knowledge about evidence-based practise (EBP) and due to the many thorough compilations of research that he has done but also in demonstrating the problems and shortcomings using EBP in relation to the field of AAC. One of these problems concerns the use of the RCT as the golden standard, as RCT studies are almost non-existent within the AAC field. There are many reasons to this but the main ones are that (1) children with communicative disabilities are so heterogenous and (2) that randomization is extremely difficult to put through due to ethical reasons. Schlosser has therefore suggested an alternative evidence hierarchy placing the meta-analysis on top (2003; Schlosser & Raghavendra, 2004). Schlosser and other prominent AAC-researchers recommend the use of

well-controlled single-subject research designs that can form the base for systematic meta-analyses.

5. The evidence-base for AAC intervention directed to children with autism

5.1 Which mode and method of AAC is best for children with autism?

5.1.1 Studies of manual sign communication for children with autism

The evaluative research on sign communication for individuals with ASD is limited. In a review article, Goldstein (2002) identified ten studies involving sign communication for children with ASD that met experimental requirements. The findings varied and mostly focused on the number of signs learned rather than functional aspects. The results suggested that sign teaching may be more effective at increasing communication in children with ASD than the teaching of spoken language.

In the results of a meta-analysis of AAC intervention outcomes for children with autism done by Wendt, Schlosser, and Lloyd (2004), 11 single-subject studies met the inclusion criteria. It was suggested that manual signs constitute a viable communication option based on a particular effectiveness measure, the Percentage of Nonoverlapping Data (PND), that is, the percentage of data points during intervention that exceeded the highest data point during baseline. The PND value for nine of the ten multiple baseline design studies was 90% to 100%; for the remaining one, it was 70% to 90%. None of these studies were published after the 1980s, which might reflect the gradual change in AAC intervention for persons with autism, as it became more focused on visual-graphic communication. Von Tetzchner and Martinsen (2000), though, report on a Norwegian survey of 64 children and adolescents with ASD in which it was seen that progress in terms of quality of language was seen only in those individuals who had been given systematic manual sign teaching. Von Tetzchner and Martinsen (2000, p. 82) criticized the fact that manual signing interventions were being abandoned and stated that 'this limits the variety of strategies that are applied and hence opportunities for learning for individuals with autism.

In a Swedish review of early intervention for children with communicative disabilities no new studies (i.e. published during the last ten years) other than review articles, involved manual sign communication alone. However, two very interesting studies comparing Picture Exchange Communication System (PECS) and manual signing were found. In the first of these it was seen that manual signing resulted in more eye-contact and vocalizations than did PECS (Anderson, 2002). However, PECS was learned faster than signing and the individuals initiated more using PECS. PECS was also better generalized to other situations (Anderson, 2002). Better generalization was also found in the other comparative study by Chambers & Rehfeldt (2003). One interesting review that reports manual signing being used within the frame of positive behaviour support is written by Bopp, Brown & Mirenda (2004). This review primarily focuses on the role of the speech-language pathologist in the delivery of positive behavior support and concludes that all 6 individuals in the survey who were trained to use signs as an alternative to the challenging behavior made progress (Bopp et.al., 2004).

5.1.2 Studies of graphic symbol use for children with autism

Experimental research is also fairly limited within the area of visual-graphic AAC for children with ASD except for an increased number of studies in the last couple of years being done on PECS (reported below). In two review articles, Mirenda (2001, 2003) reports

ten studies where non-electronic communication boards were used. According to Mirenda, the participants in these studies were usually taught to request desired objects or activities, and given appropriate opportunities and instruction many children, adolescents and adults across the range of ability can learn to use aided techniques communication for functional communication (2003, p. 205). In the previously mentioned article on the role of speech language pathologists and use of AAC in providing Positive Behavior Support, it was revealed that those studies that made use of visual schedules to enhance understanding could show that the individuals could learn to use these quickly and decrease their amount of challenging behaviours (Bopp, Brown & Mirenda, 2004).

There is now more evidence available to support the effectiveness of PECS. Preston and Carter in 2009, published a comprehensive review, also including a meta-analysis of some studies. Building on the results of altogether 456 individuals the authors concluded that PECS is an effective intervention for children with ASD as well as for children having communication problems due to other causes. PECS give children with no or limited functional communication a way of expressing themselves, Positive effects with respect to interaction and challenging behaviours were also seen in many studies. The children's use of speech also was stimulated but these effects were more limited and not so well studied. Preston and Carter points out that it is the first three steps in the PECS method that are known to be effective since almost no research has been done on the last three steps supporting different communicative functions and syntactic development.

In the studies that compare PECS with other interventions it was seen that children seemed to learn PECS faster than manual signing. In a study that compared PECS to an intervention where parents learned how to use responsive strategies and milieu teaching (RPMT) some interesting results were seen (Yoder & Stone, 2006). PECS seemed to stimulate the communication development more for those children who had poor joint attention skills. The children who had difficulties manipulating objects gained more using RPMT (Yoder & Stone, 2006). There is some evidence suggesting that children who use ecolalic speech develop speech better and faster using PECS than children who don't (Ganz, Simpson & Corbin-Newsome, 2008). In a study of PECS-training in a school setting it was concluded that it seems to be of great importance to provide continuous support and guidance to the staff to maintain the positive communication effects gained after training in and introduction of PECS (Howlin, Gordon, Pasco, Wade & Charman, 2007).

The last few years it has been more common to stress the importance of providing children with ASD with a continuous support for understanding language. This could be done using manual signing but also through pointing to pictures or graphic symbols while speaking. This method was first introduced in the 1980's by Goosens and was namned Aided Language Stimulation, shortened ALS or today ALgS (1989). The method has been used increasingly since then within the AAC field and other researchers and interventionists has adjusted the method somewhat and named it Aided Language Modeling or ALM (Drager, 2009), Natural Aided Language or NAL (Cafiero, 2005), Point-talking (Jonsson, Kristoffersson, Ferm & Thunberg, 2011) and used on a speech-generating device, System for Augmenting Language or SAL (Romski & Sevcik, 1986; Romski et.al., 2010). Many studies of graphic AAC intervention make use these methods, but few have tried to evaluate the specific effects of this intervention part. A newly published study by Romski et. al.(2010), however excluding children with ASD, show that SAL combined with training of AAC-use is en effective method to stimulate development of speech and language (2010). Compared to direct training of speech and language competencies it was proven even more effective.

According to a review by Drager (2009) on ALM for children with ASD "we have preliminary evidence that changing adults' behavior through aided modeling interventions can be effective for children with ASD" (p. 118). Drager hypothesize that it is the combination of the following that makes the different methods of aided modeling interventions effective: 1) implementation during opportunities that arise out of natural contexts and 2) presentation of both verbal and aided symbol augmented input to expand vocabulary.

5.1.3 Studies of the use of speech-generating devices for children with ASD

Speech-generating devices (SGDs), also referred to as VOCAs (Voice Output Communication Aids) in the literature, are portable electronic devices that produce synthetic or digitized speech output. Pictures or text of any kind can be used to represent the messages on the display. SGDs were first used in the 1980s and since then a range of models have been developed, from very simple ones with a single message, to advanced models in which large – theoretically infinite – vocabularies can be used. The latter are typically software-based and most also have pre-programmed applications available, free or for sale, that are designed to meet the needs of users at different language levels and ages. Unfortunately, with very few exceptions, they are only available in English. Improvements in computer technology in recent years have changed the relationship between low- and high-technology-based pictorial systems with respect to access and portability. SGDs, apart from the simplest models, used to be problematic to access and transport for people with communication problems who were not wheelchair-bound, while a communication book of some sort was often easier to carry around. A communication book can still be small and handy, but today it is more limited than commercial handheld computers and smartphones. The latter can contain large vocabularies with speech output and at the same time allow more advanced users to take and store photos, record messages, make phone calls and send symbol-based text messages. The development of improved speech output software has also resulted in computers becoming far more effective means of communication (Howlin, 2006).

A potential advantage with SGDs is the ability to facilitate natural personal interactions and socialization by virtue of the speech output they provide (Mirenda, 2003). A study that reports on these variables was done by Schepis, Reid, Behrmann, and Sutton in 1998. The four children in this study, all of whom were three to five years old and diagnosed with autism, were given access to an SGD; through naturalistic teaching procedures, they learned to make requests, answer questions, and make social comments during natural play and/or a snack routine at their preschool. There was also an increase in classroom staff members' communicative interactions with the children. The authors speculated that this increase might be due to the recent training, but that it might also be due to the new ease of understanding the children's SGD communication. This study was done on children at a prelinguistic level, using SGDs in a school setting; the same is true of almost all of the research done in the field of SGD intervention for children (and adolescents) with ASD.

In the series of studies by Sigafoos and colleagues (2001, 2003, 2004a, 2004b, 2004c, 2005), different aspects of SGD intervention were studied. In their 2001 article, Sigafoos and Drasgow used a case study to demonstrate the need for individuals with severe communication impairments to have access to different modes of AAC to use in different situations and settings and with different communications partners. The participant in this

study demonstrated rapid acquisition and conditional use of manual signing and an SGD. The boy always chose to use the SGD when it was present, but when it was absent, he used his corresponding manual sign to communicate. It was speculated that the SGD was visually more salient and that it was a more efficient response because it appeared to require less effort to use. In this case, contrary to other clinical reports, the boy used only his own speech together with manual signing, and not an SGD. Sigafoos et al. (2003) studied the specific role of speech output. Following the acquisition of the ability to request preferred objects using an SGD, rates of requesting and vocalization across speech output conditions (on and off) were compared. No major differences were found and the authors suggested that access to preferred objects, rather than the effect of the speech output, was the critical variable in maintaining the use of SGDs. One of the three children began to speak single words during the intervention, suggesting that SGD intervention may facilitate speech in some cases. In the next study, Sigafoos et al. (2004b) reported on an intervention to teach students to locate their AAC device or SGD, when it was not accessible. After an initial period of teaching the students to request access to preferred objects, a least-to-most prompting procedure was implemented to teach them to locate their device. The intervention proved effective in all three adolescents who participated in the study. The students were also taught to turn the device on. The speech output seemed to provide an important source of feedback the participants needed to master this skill. Sigafoos et al. (2004a) investigated whether two students at a prelinguistic level could learn to use an SGD to repair communicative breakdowns. The intervention was effective and the participants also began to use the SGDs to initiate requests even when communication breakdowns had not occurred.

Romski and Sevcik (1996), are the only researchers reporting a longitudinal study. Two individuals with autism were included in the investigation of the System of Augmenting Language (SAL). The individuals with ASD in the study both belonged to the group of participants who achieved the best success. Although the rest of the group were not diagnosed with ASD, it should be mentioned that Romski and Sevcik suggested that factors related to speech comprehension and representational skills seemed to distinguish the advanced from the beginning achievers in their group of 11 participants (Romski & Sevcik, 1996).

5.1.4 Answer to the question of best AAC-approach

The answer to this question is that there is no clear answer, or at least no answer depicting one AAC-mode as better than the others. The three main methods being manual signing, graphic AAC including PECS and graphic AAC used together with speech output seem all to be effective in promoting communication and development of speech and language. There have also been very few attempts to compare the relative effectiveness of these approaches. In a systematic review of the research done on manual signs and graphic symbols used in ASD the author comes to the conclusion that the research base is not large enough to reliably inform clinical decision making (Wendt, 2008). He states that "Individuals with ASD constitute a very heterogeneous group; evidence is emerging to indicate that the selection of an AAC approach must be made relative to specific task demands and individual characteristics, rather than on the basis of general predictive and prescriptive indicators." However, Wendt in his review summarizes the advantages and disadvantages of manual and graphic AAC according to the information in table 1:

Approach	+ Advantages	- Disadvantages
Graphic symbols	+ Visual learning often intact and good in ASD + Less demand on memory + Easy to understand for partners + Easier to prompt	- Visual discrimination skills - Low rate of communication - Problems with access, must be carried - Turntaking more difficult - Grammatical and/or semantic relations more diffifult to transmit - Access to good technologies, tools and knowledge to produce symbol material and apps
Manual signing	+ Always accessible + Possible to develop to a full and rich language system + More natural, transient and easy to fit into human interaction, including eye contact	partners must be able to produce and understand signs problems with executive functions and motor impairment such as dyspraxia, motor planning problems, memory and mobilization may prevent acquisition and use

Table 1. Disadvantages (-) and advantages (+) with manual and graphic AAC (Wendt, 2008).

A study by Sigafoos et al. (2009) compared the use of Picture Exchange and SGD for an adolescent boy with Down Syndrome and an autistic disorder. The conclusion was that the two systems were equally viable modes of communication.

Instead several studies, especially the more recently published, seem to arrive to the same recommendations in their discussion and conclusions, namely that the use of combined modes, multimodal AAC, seems to work best for children with communication difficulties (Branson & Demchak, 2009; Mirenda & Beukelman, 2005). Communication is multimodal in nature and the use of different modes to different extents depending on the situation, topic and the partner, is inherent. So in a way it's given and not surprising that the same must apply to children with disabilities. Different modes support and complement each other. For example, there is strong evidence that pictures are better learned when they are presented together with speech ouput (Schlosser & Sigafoos, 2006). Wendt in his review of manual and graphic AAC suggests that "Given the high training demands placed on communication

partners by manual signs and their relatively high fine motor (hand) requirements, manual signs might best be included as one component of a multimodal communication system that also includes graphic symbols, SGDs, and individuals extant communication modalities (e.g., gestures, vocalizations, facial expressions)." (2008).

5.2 Does AAC hinder or facilitate development of speech?

Whether AAC hinders or facilitates the development of speech is a very important question. In spite of the multimodal nature of human communication it seems to be an innate force in humans and parents to promote use of speech. As soon as the prelinguistic child starts to use spoken words these are responded to and reinforced by the parent to a greater extent than other signals such as gestures (Volterra, Caselli, Capirci & Pizzuto, 2004). Since speech seems to be on the parental agenda it's important to discuss speech development and AAC with parents, even in if it's not brought up (Jonsson, Kristoffersson, Ferm & Thunberg, 2011). Unfortunately we don't yet have so much evidence when it comes to effects on the use of AAC on speech development. There are several studies that report effects on speech development but almost all of them as a side effect since most AAC interventions have the goal to improve communication, not specifically oral language (Beukelman & Mirenda, 2005). A high-quality review done by Millar, Light & Schlosser (2006) on the effects reported on speech in AAC-studies included several individuals with autism. It was concluded that AAC interventions do not appear to have a negative effect on speech production. One of the authors of this review article updated the search only including individuals with ASD (Millar, 2008). The result of the earlier review was again confirmed and it was seen that most of the existing research suggests that AAC may enhance speech development in individuals with ASD. It was also seen that a variety of instruction methods used in the interventions seemed to trigger speech, for example the use of time delay (Millar, 2008).

5.3 When can you start to use AAC – are there any necessary prerequisites that must be met?

The question of when you should start an AAC intervention has also been a matter of discussion, and partly connected to the above mentioned wish and hope in parents to train and/or wait for speech. Earlier, during the 1980's and 1990's, it was also common among professionals within AAC-teams and other professionals to regard certain skills as necessary prerequisites for a successful AAC-introduction. Among these were the capacity to interpret pictures/symbols, good seating, a means of pointing/indicating, understanding of language.

During the last ten years there has been a change in thinking and what is said now is that it never can be too early to start a communication intervention, and that AAC is an important tool (Branson & Demchak; 2009, Sigafoos, Drasgow & Schlosser, 2003). Both researchers and clinicians often work according to the insights and theories of typical development of language and communication: namely that a child has to be exposed to language long before he/she is expected to understand or use it him/herself (Drager, 2009). The mere thought of only using spoken words to a little child that we know he or she can understand is ridiculous. We immediately realize this is impossible – but still that is how we have done with respect to AAC, specifically graphic AAC with or without speech output. When it comes to SGDs some practitioners might well have stated that a SGD was too advanced for the child whilst he or she still used a lot of spoken language to the child.

Today, most researchers and AAC specialists hold that the very early and multimodal start of AAC is the only ethical one; we have to provide all the help that we can; With respect to iconicity manual signing was thought to be too an abstract system for individuals on the autism spectrum having easier to use and understand symbols with more resemblance to their referents. Problems with intelligibility refers to the fact that manual signs are not so easy to interpret for communication partners not so familiar with the child and/or manual signs. We can't know in beforehand what modes or methods that are going to work best in the future for the child, in a given situation and with a certain communication partner (Branson & Demchak; 2009, Sigafoos, Drasgow & Schlosser, 2003). If any prerequisites are needed these are connected to the communication partner, not the child. A basic knowledge in communication and the use of responsive strategies probably is needed to make AAC work in daily interactions (Thunberg, Ahlsén & Dahlgren Sandberg, 2007, Iacono, 1999).

5.4 What to consider to make AAC work in daily interaction?

During my more than 20 years working as an AAC specialist I have seen just too many examples of AAC systems not being used. It is important to ask oneself if it might be that it is not working to use technologies (be they low- or high-) in human interaction? It probably is very difficult and demanding but as a specialist I also have seen some really good examples when everything works beautifully.

I have also had the opportunity to try AAC myself – in my own home and reality. About a year after my second child was born I realized that he had problems with communication, since he did not show any interest in speech. At the age of three when he finally was given his diagnosis of autism and we landed as a family, I had the energy to start up AAC intervention in my own home. We used a multimodal intervention: manual signs, picture boards, visual schedules, SGDs and computers. And it worked! In my son's case it was the SGD that really helped him to crack the code of language: after hundreds and hundreds of activations of his messages on the SGD he realized what spoken words were all about. During a year he used this beautiful mix of all communication modes and began to speak more and more – the computer and SGD maybe being the best teachers: so patient and so consequent.

This experience led me into research and my doctoral studies. During a year I video-taped four families communicating with or without an SGDs in different activities using SAL (Thunberg, 2007). It was seen that the access to the device improved communication in most activities, which was very positive. Observing all the tapes I also realized that the families would have needed more knowledge in communication and responsive strategies. It was very common to observe that the parents used a dominant communication style characterized by directives. Knowing the families so well I could see that the results with respect to interaction would probably have been much better had I given the families a better basic knowledge in communication and strategies to use.

This led me to my ongoing projects: one about parental education (AKKtiv) and one about creating communicative environments in schools for children with ASD. Common for both these projects is that the introduction of AAC is preceeded by education and training in the use of responsive strategies (Jonsson, Kristoffersson, Ferm & Thunberg, 2011). Our results so far are very positive and goes along the line of other research that also point out the

importance of providing basic knowledge in communication and responsive strategies before introducing AAC (Iacono, 1999).
Another important factor to make AAC work is that the people involved, the network, have been part of the AAC process and in decision-making (Granlund, Björck-Åkesson, Wilder & Ylvén, 2008, Goldbart & Marshall, 2007). No matter what fancy AAC-systems a specialist team can provide – if the significant persons surrounding a child are not involved and feel insecure or resistant – this system won't have a chance to work due to the transitional nature of communication. In the planning of an AAC solution the energy therefore are best spent on assessing environmental factors and the social network rather than the more traditional structural/functional factors. This assessment is also important for identifying the communicative interactional needs that helps identifying the topics and vocabulary that will be meaningful to use for the child. And this factor is also one predicting a positive outcome of an AAC intervention.

6. Conclusion

The field of AAC is a fairly new field of knowledge that has gradually grown as there is a growing interest in functional communication and in ensuring the communicative rights of individuals with disability. There has also been an explosion of available communication technologies and methods that can support and improve communication for individuals with autism. We have probably and hopefully only seen the dawn of these new options. It is also possible to see that we are moving from using one technique or approach at the time to working with multimodal techniques or approaches were different tools and methods combined with an understanding of communication and use of interactional strategies build a total system of communication.
The research base with respect to AAC used by children with autism has grown in recent years. This research mostly consists of singe-subject-design studies and case studies, with very few controlled group studies being done. On the other hand there are some well-done meta-analyses published that compile results from singe-subject research studies. Due to the difficulties of conducting RCT studies within the field of AAC-intervention the meta-anlyses are important and can be seen as the golden standard.
In conclusion, meta-analyses and other studies show that AAC-interventions are cost-effective and give fast results and tend to stimulate speech development. The best results seem to be reached when the social network surrounding a child is given support and resources to be able to use responsive strategies and provide communication opportunities and direct training using AAC in natural daily interactions. AAC intervention should be started as soon as communication difficulties are displayed or suspected since AAC promotes communication, language and speech. AAC-intervention has also been proved to effectively decrease challenging behaviors. There is today no mode of AAC that is known to be better than any other. Instead multimodal approaches seem to be the most effective. However, graphic AAC seem to be acquired at a faster rate and also easier to generalize to other situations. PECS has been proved to be an effective AAC method, specifically at early stages of communication and with respect to the first three phases of the method.

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8. References

American Psychiatric Association. (1994). *Diagnostic and statistical manual of mental disorders* (4th ed.). Washington, DC: Author.

American Speech-Language-Hearing Association. (2005). Roles and responsibilities of speech-language pathologists with respect to augmentative and alternative communication: Position Statement. Rockland, MD: Author.

Anderson, A.E. (2002). *Augmentative communication and autism : A comparison of sign language and the Picture Exchange Communication System*. Doctoral dissertation, University of California at Santa Barbara, 2001. *Dissertation Abstracts International : Section B : The Sciences and Engineering,* 62, 4269.

Beukelman, D. R., & Mirenda, P. (2005). *Augmentative and alternative communication* (3rd ed.). Baltimore, MD: Paul H. Brookes Publishing.

Billstedt, E. (2007). *Children with autism grow up: Use of the DISCO (Diagnostic Interview for Social and COmmunication disorders) in population cohorts*. Göteborg: Göteborg University.

Billstedt, E., Gillberg, I. C., & Gillberg, C. (2005). Autism after adolescence: Population-based 13-22-year follow-up study of 120 individuals with autism diagnosed in childhood. *Journal of Autism and Developmental Disorders*, 35, 351–360.

Bishop, D., Hartley, J., & Weir, F. (1994). Why and when do some language-impaired children seem talkative? A study of initiation in conversation of children with semantic-pragmatic disorders. *Journal of Autism and Developmental Disorders*, 24, 177–197.

Bliss, C. (1965). Semantography. Sidney: Semantography Publications.

Blissymbolics Communication International. (2011). Retrieved April 2011, from http://www.blissymbolics.org.

Bondy, A., & Frost, L. (1994). The Picture Exchange Communication System. Focus on Autistic Behavior, 9, 1–19.

Bopp, K., Brown, K. & Mirenda, P. (2004). Speech-Language Pathologists' Roles in the Delivery of Positive Behaviour Support for Individuals With Developmental Disabilities. *American Journal of Speech-Language Pathology, vol 13,* 5-19

Bryson, S. (1996). Brief report: Epidemiology of autism. *Journal of Autism and Developmental Disorders*, 26, 165–167.

Bryson, S., Clark, B. S., & Smith, T. M. (1988). First report of a Canadian epidemiological study of autistic syndromes. *Journal of Child Psychology and Psychiatry*, 29, 433–445.

Cafiero, J. M. (2005). *Meaningful Exchanges for People with Autism,* Bethesda, MD: Woodbine House.

Carr, E. G., Levin, L., McConnachie, G., Carlson, J. I., Kemp, D. C., & Smith, C. E. (1997). *Communication-based intervention for problem behavior*. Baltimore, MD: Paul H. Brookes Publishing.

Chambers, M., & Rehfeldt, R. A. (2003). Assessing the acquisition and generalization of two mand forms with adults with severe developmental disabilities, *Research in Developmental Disabilities,* 24, 265-280.

Charman, T., Baron-Cohen, S., Swettenham, J., Baird, G., Drew, A., & Cox, A. (2003). Predicting language outcome in infants with autism and pervasive developmental disorder. *International Journal of Language and Communication Disorders*, 38, 265–285.

Chawarska, K., Paul, R., Klin, A., Hannigen, S., Dichtel, L. E., & Volkmar, F. (2007). Parental recognition of developmental problems in toddlers with autism spectrum disorders. *Journal of Autism and Developmental Disorders*, 37, 62–72.

Dahlgren, S. O., & Gillberg, C. (1989). Symptoms in the first two years of life: A preliminary population study of infantile autism. *European Archives of Psychiatric and Neurological Science*, 283, 169–174.

Danielsson, H., & Jönsson, B. (2001). Pictures as language. *Paper presented at the International Conference on Language and Visualisation,* Stockholm.

Dawson, G., & Osterling, J. (1997). Early intervention in autism. In M. J. Guralnick (Ed.), *The effectiveness of early intervention* (pp. 307–326). Baltimore, MD: Paul H. Brookes Publishing.

Drager, K. (2009). Aided modeling interventions for children with autism spectrum disorders who require AAC. *Perspectives on Augmentative and Alternative Communication.* 114-120.

Eklöf Wicksell, G. (1998). *Kartläggning av förskrivning av datorbaserade hjälpmedel sett ur skolperspektivet [A survey of prescription of computerized aids from a school perspective].* Stockholm: Swedish Handicap Institute.

Fombonne, E. (2005). Epidemiological studies of pervasive developmental disorders. In F. Volkmar, R. Paul, A. Klin & D. Cohen (Eds.), *Handbook of autism and pervasive developmental disorders* (Vol. 1, pp. 42–69). Hoboken, NJ: John Wiley & Sons.

Freeman, B. J. (1997). Guidelines for evaluating intervention programs for children with autism. *Journal of Autism and Developmental Disorders*, 27(6), 641-651.

Ganz, J. B., & Simpson, R. L. (2004). Effects on communicative requesting and social development of the Picture Exchange Communication System in children with characteristics of autism. *Journal of Autism and Developmental Disorders*, 34, 395–409.

Ghaziuddin, M., & Gerstein, L. (1996). Pedantic speaking style differentiates Asperger syndrome from high-functioning autism. *Journal of Autism and Developmental Disorders*, 26, 585–595.

Goldstein, H. (2002). Communication intervention for children with autism: A review of treatment efficacy. *Journal of Autism and Developmental Disorders*, 32, 373–396.

Goossens, C. (1989). Aided communication intervention before assessment: a case study of a child with cerebral palsy. *Augmentative and Alternative Communication, 5,* 14-26.

Granlund, M., Björck-Åkesson, E., Wilder, J., & Ylvén, R. (2008). AAC interventions for children in a family environment: Implementing evidence in practice. *Augmentative and Alternative Communication, 24,* 207-219.

Heimann, M., Nelson, K., Tjus, T., & Gillberg, C. (1995). Increasing reading and communication skills in children with autism through an interactive multimedia computer program. *Journal of Autism and Developmental Disorders*, 25, 459–480.

Howlin, P. (1989). Changing approaches to communication training with autistic children. *British Journal of Disorders of Communication*, 24, 151–168.

Howlin, P. (2006). Augmentative and alternative communication systems for children with autism. InT. Charman & W. Stone (Eds.), *Social and communication development in autism spectrum disorders* (pp. 236–266). New York: The Guildford Press.

Howlin, P., Goode, S., Hutton, J., & Rutter, M. (2004). Adult outcomes for children with autism. *Journal of Child Psychology and Psychiatry*, 45, 212–229.

Howlin P., Gordon K., Pasco G, Wade a., Charman T. (2007). The effectiveness of Picture Exchange Communication System (PECS) training for teachers of children with autism: a pragmatic, group randomised controlled trial.

Iacono, T., (1999). Language Intervention in Early Childhood. International journal of Disability, Development and Education, 46, 383-420.

Johansson, I. (1981). Språk- och talutveckling hos barn med downs syndrom [Development of language and speech in children with Downs syndrome]. Umeå: Department of Linguistics.

Jonsson, A., Kristoffersson, L., Ferm, U., & Thunberg, G. (2011). The ComAlong communication boards: Parents' use and experiences of aided language stimulation. Forthcoming in *Augmentative and Alternative Communication.*

Kurita, H. (1985). Infantile autism with speech loss before the age of 30 months. *Journal of the American Academy of Child Psychiatry*, 24, 191–196.

Lord, C. (1995). Follow-up of two-year olds referred for possible autism. *Journal of Child Psychology and Psychiatry*, 36, 1365–1382.

Lord, C., Risi, S., & Pickles. (2004). *Trajectory of language development in autism spectrum disorders*. In R. M & S. Warren (Eds.), Developmental language disorders: From phenotypes to etiologies (pp. 7–29). Mahwah, NJ: Lawrence Erlbaum.

Lord, C., Schulman, C., & DiLavore, P. (2004). Regression and word loss in autistic spectrum disorders. *Journal of Child Psychology and Psychiatry*, 45, 936–955.

Lovaas, O. I., Koegel, R. L., Simmons, J. Q., & Long, J. S. (1973). Some generalization and follow-up measures on autistic children in behaviour therapy. *Journal of Applied Behavior Analysis*, 6, 131–166.

Maharaj, S. (1980). *Pictogram ideogram communication*. Regina, SK: The George Reed Foundation for the Handicapped.

Marshall, J., Goldbart, J. (2007) 'Communication is everything I think.' Parenting a child who needs Augmentative and Alternative Communication (AAC)', *International Journal of Language & Communication Disorders,* 43: 1, 77 -98.

Mayer-Johnson, R. (1981). *The picture communication symbols book*. Solana Beach, CA: Mayer-Johnson Co.

Millar, D. C. (2008). Effects of AAC on the natural development speech development of individuals with autism spectrum disorders. In P. Mirenda & T. Iacono (Eds), *Autism Spectrum Disorders and AAC* (pp. 171-192). Baltimore : Paul H. Brookes Publishing.

Mirenda, P. (2001). Autism, augmentative communication, and assistive technology: What do we really know? *Focus on Autism and Other Developmental Disabilitie*s, 16, 141–151.

Mirenda, P. (2003). Toward functional augmentative and alternative communication for students with autism: Manual signs, graphic symbols, and voice output communication aids. Language, Speech, and Hearing Services in Schools, 34, 203–216.

Mirenda, P., & Erickson, K. A. (2000). Augmentative communication and literacy. In B. M. Prizant & A. M. Wetherby (Eds.), *Autism spectrum disorders: A transactional developmental perspective* (pp. 369–394). Baltimore, MD: Paul H. Brookes Publishing.

Mundy, P., Sigman, M., & Kasari, C. (1990). A longitudinal study of joint attention and language development in autistic children. *Journal of Speech and Hearing Research,* 38, 157–167.

Olsson, G. (1998). *Kartläggning av förskrivning av datorbaserade hjälpmedel [Survey of prescription of computerized aids*]. Stockholm: Swedish Handicap Institute.

Osterling, J., & Dawson, G. (1994). Early recognition of children with autism: A study of first birthday home videotapes. *Journal of Autism and Developmental Disorders*, 24, 247–258.

Preston, D. & Carter, M. (2009). A Review of the Efficacy of the Picture Exchange Communication System Intervention. *Journal of Autism and Developmental Disorders (2009) 39:1471-1486*

Ramberg, C., Ehlers, S., Nydén, A., Johansson, M., & Gillberg, C. (1996). Language and pragmatic functions in school-age children on the autism spectrum. *European Journal of Disorders of Communication*, 31, 387–413.

Rogers, S. (2006). Evidence-based interventions for language development in young children with autism. In T. Charman & W. Stone (Eds.), *Social and communication development in autism spectrum disorders* (pp. 143–179). New York: The Guildford Press.

Romski, M. A., & Sevcik, R. A. (1996). *Breaking the speech barrier: Language development through augmented means.* Baltimore, MD: Paul H. Brookes Publishing.

Romski, M. A., & Sevcik, R. A., Adamson, L. B., Cheslock, M., Smith, A., Barker, R. M., & Bakeman, R. (2010). Randomized comparison of augmented and nonaugmented language interventions for toddlers with developmental delays and their parents. *Journal of Speech, Language and Hearing Research*, 53, 350-364.

Schepis, M. M., Reid, D. H., Behrmann, M. M., & Sutton, K. A. (1998). Increasing communicative interactions of young children with autism using voice output communication aids and naturalistic teaching. *Journal of Applied Behavior Analysis*, 31, 561–578.

Schlosser, R. W. (2003a). Roles of speech output in augmentative and alternative communication: Narrative review. *Augmentative and Alternative Communication*, 19(1), 5-27.

Schlosser, R. W. (2003b). *The Efficacy of Augmentative and Alternative Communication: Towards Evidence-Based Practice. Baltimore*: Paul Brookes.

Schlosser, R. W., & Blischak, D. M. (2001). Is there a role for speech output in interventions for persons with autism. *Focus on Autism and Other Developmental Disabilities*, 16, 170–176.

Schlosser, R. W., Raghavendra, P. (2004). Evidence-Based Practice in Augmentative and Alternative Communication. *Augmentative and Alternative Communication, 20,* 1-21.

Schopler, E., Reichler, R., & Lansing, M. (1980*). Teaching strategies for parents and professionals*. Austin, TX: PRO-ED Inc.

Seal, B. C., & Bonvillian, J. D. (1997). Sign language and motor functioning in students with autistic disorders. *Journal of Autism and Developmental Disorders*, 27, 437–466.

Shea, V., & Mesibov, G. (2005). Adolescents and adults with autism. In F. Volkmar, R. Paul, A. Klin & D. Cohen (Eds.*), Handbook of autism and pervasive developmental disorders* (pp. 288–311). Hoboken, NJ: John Wiley & Sons.

Short, C., & Schopler, E. (1988). Factors relating to age of onset in autism. Journal of Autism and Developmental Disorders, 18, 207–216.

Sigafoos, J., Didden, R., & O'Reilly, M. (2003). Effects of speech output on maintenance of requesting and frequency of vocalizations in three children with developmental disabilities. *Augmentative and Alternative Communication*, 19, 37–47.

Sigafoos, J., & Drasgow, E. (2001). Conditional use of aided and unaided AAC. *Focus on Autism and Other Developmental Disabilities*, 16, 152–161.

Sigafoos, J., Drasgow, E., Halle, J. W., O'Reilly, M., Seely-York, S., Edrisinha, C., et al. (2004a). Teaching VOCA use as a communicative repair strategy. *Journal of Autism and Developmental Disorders*, 34, 411–422.

Sigafoos, J., Drasgow, E., & Schlosser, R. (2003). Strategies for Beginning Communicators. I Schlosser (Red.), *Efficacy in Augmentative and Alternative communication* (pp. 323-346). Amsterdam: Academic Press.

Sigafoos, J., O'Reilly, M., Ganz, J. B., Lancioni, G. E., & Schlosser, R. W. (2005). Supporting self-determination in AAC interventions by assessing preference for communication devices. *Technology and Disability*, 17, 143–153.

Sigafoos, J., O'Reilly, M., Seely-York, S., & Edrisinha, C. (2004b). Teaching students with developmental disabilities to locate their AAC-device. *Research in Developmental Disabilities*, 25, 371–383.

Sigafoos, J., O'Reilly, M., Seely-York, S., Weru, J., Son, S. H., Green, V. A., et al. (2004c). Transferring AAC intervention to the home. *Disability and Rehabilitation*, 26, 1330–1334.

Sigafoos, J., Green, V., Payne, D., Son, S., O'Reilly, M., & Lancioni, G. E. (2009). A comparison of picture exchange and speech-generating devices : acquisition, preference, and effects on social interaction. *Augmentative and Alternative Communication,* 25, 99-109.

Tager-Flusberg, H., & Anderson, M. (1991). The development of contingent discourse ability in autistic children. *Journal of Child Psychology and Psychiatry*, 32, 1123–1134.

Tager-Flusberg, H., & Joseph, R. M. (2003). Identifying neurocognitive phenotypes in autism. *Philosophical Transactions of the Royal Society of London, Series B: Biological Sciences*, 358, 303–314.

Tager-Flusberg, H., Joseph, R., & Folstein, S. (2001). Current directions in research on autism. *Mental Retardation and Developmental Disabilities Research Reviews*, 7, 21–29.

Tager-Flusberg, H., Paul, R., & Lord, C. (2005). Language and communication in autism. In F. Volkmar, R. Paul, A. Klin & D. Cohen (Eds.), *Handbook of autism and pervasive developmental disorders* (Vol. 1, pp. 335–364). Hoboken, NJ: John Wiley & Sons.

Thunberg, G. (2000). *Konsekvenser av IT-insatser för personer med autism [Consequences of IT-based interventions to individuals with autism].* Stockholm: Swedish Handicap Institute.

Thunberg, G. (2007). Using speech-generating devices at home. A study of children with autism spectrum disorders at different stages of communication development. *Gothenburg Monographs in Linguistics* 34. Göteborg, Sweden: Göteborg University.

Thunberg, G., Ahlsén, E., & Dahlgren Sandberg, A. (2007) Autistic Spectrum Disorders and Speech-Generating Devices - Communication in Different Activities at Home. *Clinical Linguistics and Phonetics*, 21, 457-479.

Tjus, T., Heimann, M., & Nelson, K. (1998). Gains in literacy through the use of a specially developed multimedia research strategy: Positive findings from 13 children with autism. *Autism: International Journal of Research and Practice*, 2, 139–156.

Volterra, V., Caselli, C., Capirci, O., & Pizzuto, E. (2004). *Gesture and the emergence and development of language.* Rome: Unpublished manuscript.

von Tetzchner, S., & Martinsen, H. (2000). *Introduction to augmentative and alternative communication*. London: Whurr Publishers.

Watson, L. R., Baranek, G. T., Crais, E. R., Reznick, S. J., Dykstra, J., & Perryman, T. (2007). The first year inventory: Retrospective parent responses to a questionnaire designed to identify one-year olds at risk for autism. *Journal of Autism and Developmental Disorders*, 37, 49–61.

Wendt, O. (2008). Research on the use of manual signs and graphic symbols in autism spectrum disorders A systematic review. In P. Mirenda & T. Iacono (Eds), *Autism Spectrum Disorders and AAC* (pp. 83-139). Baltimore : Paul H. Brookes Publishing.

Wendt, O., Schlosser, R. W., & Lloyd, L. (2004). A meta-analysis of AAC intervention outcomes in children with autism. *Paper presented at the 11th biennial conference of the International Society for Augmentative and Alternative Communication*, Natal, Brazil.

Wetherby, A. M. (1986). Ontogeny of communicative functions in autism. *Journal of Autism and Developmental Disorders*, 16, 295–316.

Wetherby, A. M. (2006). Understanding and measuring social communication in children with autism spectrum disorders. In T. Charman & W. Stone (Eds.*), Social and communication development in autism spectrum disorders* (pp. 3–34). New York: The Guildford Press.

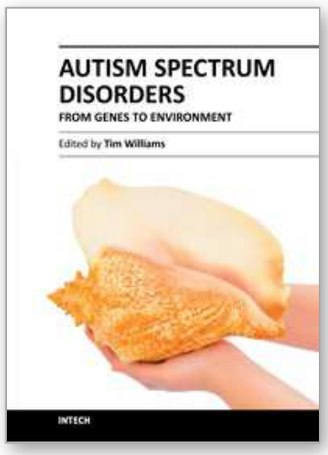
Wetherby, A. M., Prizant, B. M., & Schuler, A. L. (2000). Understanding the nature of communication and language impairments. In A. M. Wetherby & B. M. Prizant (Eds.), *Autism spectrum disorders: A transactional developmental perspective* (pp. 109–141). Baltimore, MD: Paul H. Brookes Publishing.

Widgit Software. (2002). *Widgit rebus symbol set*. Retrieved March 2007 from www.widgit.com/products/wws2000/about_symbols/WWS2000Widgit-Rebus.htm.

Woodcock, R., Clark, C., & Davies, S. (1968). *Peabody rebus reading program*. Circle Pines, MN: AGS Publishing.

Yoder, P. J., & Layton, T. L. (1988). Speech following sign language training in autistic children with minimal verbal language. *Journal of Autism and Developmental Disorders*, 18, 217–230.

Yoder, P. & Stone, W. L. (2006). A Randomized Comparison of the Effect of Two Prelinguistic Communication Interventions on the Acquisition of Spoken Communication in Preschoolers With ASD. *Journal of Speech, Language and Hearing Research, August 2006, Vol. 49, pp. 698-771.*



Autism Spectrum Disorders - From Genes to Environment
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Autism spectrum disorders are a major topic for research. The causes are now thought to be largely genetic although the genes involved are only slowly being traced. The effects of ASD are often devastating and families and schools have to adapt to provide the best for people with ASD to attain their potential. This book describes some of the interventions and modifications that can benefit people with ASD.

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